A plant-based natural surfactant with potential applications in the remediation of contaminated soils was obtained from the dry fruit pericarps of Sapindus mukorossi,. Kinetics of microbial growth in the natural surfactant solution under batch aerobic conditions was shown to be dependent on the initial concentrations of the surfactant, and a typical diauxic pattern was observed at high concentrations. This unique pattern may be attributed to the two components in the surfactant solutions that are of different biodegradabilities, and to the inhibition effects of the preferential substrate at high concentrations. Based on the generalized Monod equation, a new mathematical model is proposed to account for this growth pattern. During the exponential growth period, specific growth rates (μ) were in the range of 0.0188 and 0.2574 hr, which corresponds a doubling time (tD,), of 3 to 37 hours. Parameters for the Monod model were estimated to be 1.08 hr and 11200 mg/L for μmax, and K,S,, respectively. A model similar to the logistic growth equation was used to express microbial growth at a low concentration range from 200 to 2500 mg/L, and a discrete model was developed to describe the biphasic growth curve at a high concentration of 6000 mg/L. Model parameters were estimated by a non-linear least-squares method. The model was in good agreement with the experimental data for the monoauxic growth at low concentrations, and diauxic growth at high concentrations of the surfactant.